THE NATURE CONSERVANCY NEWS

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THE NATURE CONSERVANCY NEWS

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COVER: In flight over Pelekunu Valley and the Conservancy's projected Kamakou Preserve, Molokai. Photo by R. M. Towill.

The Nature Conservancy is a national conservation organization committed to the preservation of natural diversity by protecting lands containing the best examples of all components of our natural world.

To date the Conservancy and its members have been responsible for the preservation of 1,863,964 acres of forests, marshes, prairies, mountains, and islands: home to rare and endangered species of wildlife and plants. 2,922 projects have been completed since the acquisition of the first preserve in 1954. Approximately 60% of all preserves are retained by the Conservancy and managed by staff and volunteer land stewards.

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Hawaii: A Museum of Evolution

by Sherwin Carlquist

OF ALL THE MAJOR volcanic islands in the world, those of the Hawaiian chain are the most remote from any continent, or from any other islands of appreciable size. They have never been connected to any continent; but despite their supreme isolation in the mid-Pacific, the Hawaiian Islands were colonized by a wide variety of plants and animals millions of years before the arrival of humans. Over time, those colonists have diversified into a remarkable number of species. But more striking than the numbers are the range of adaptations that the species represent.

How were the islands colonized, and how did the flora and fauna evolve into forms quite different from their mainland ancestors? The simplest answer is that life came to the Hawaiian Islands by air, on ocean currents, and attached to migratory birds. Most of the colonizing insects were small enough to float for long periods of time in the air, unaided by their wings. Spores of ferns and tiny seeds belonging to a very few flowering plants were also able to float in the air. Rapidly moving air masses, such as those of great weather systems or the jet streams, very likely carried this aerial flotsam to the islands. Some seeds (mostly those of beach plants) floated to Hawaii on ocean currents, and a few plants may have arrived as floating branches, or as whole plants caught in mats of vegetation—so-called "natural rafts." Two kinds of lizard, or their eggs, probably reached Hawaii by riding on these rafts.

Small land snails most likely reached the islands by traveling on the feathers of migrating birds, glued by mucus-like secretions. Birds also carried fruits and seeds—some sticky, others with barbed, hooked, or bristly surfaces—and released them on Hawaiian soil when they preened their feathers after a migratory flight. Many flowering plants may have been brought to the islands by migrating birds that ate fleshy fruits or seeds, carried them internally, and excreted them on the islands. (While migratory bird species are primarily insectivorous, shorebirds known to travel to the Hawaiian Islands each year have been observed consuming fruits and seeds.)

FROM WHAT LANDS did the original plant and animal colonists travel? Because there is no nearby land mass, no single source existed for stocking the Hawaiian Islands. Major wind patterns flow chiefly from Asia; so not surprisingly, organisms that arrived in a windborne fashion, like the insects, are related to Asian species. Meanwhile, the land snails and flowering plants that were brought by the birds have relatives in the migratory ports of call where those birds stopped to rest, in both Asia and North America.

Ancestors of the native flora and fauna of Hawaii are often said (though this is a generalization) to have come from Southeast Asia and the island east of Asia. Yet an appreciable number of the first colonists must have arrived from the far north, the far south, and areas in between, given the locations of species most closely resembling the plants and animals of Hawaii today. No less than 22 percent of the original flowering plant immigrants to the islands are believed to have crossed from either North or South America.

The climate, geology, and topography of the Hawaiian Islands were ideal for the establishment and successful survival of its first colonists. The islands' mountains, which lie in the interface between tropics and subtropics, are frost-free (below 7,000 feet) even in winter. Rainfall is abundant. The driest site in the archipelago receives about 15 inches of rain per year, while the wettest (Mt. Waialeale, Kauai) receives as much as 600 inches each year. Light summer rains from the trade winds also sprinkle the mountains, so uplands are never truly dry although the lowlands may be. The climate is especially appropriate for fostering wooded lowlands surrounding evergreen cloud forests.

GEOLOGY AND TOPOGRAPHY provided an impetus for rapid diversification of the plant and animal colonists. A colonist group tends to split into several species where habitats favorable to it are isolated from each other. And Hawaii is rich in this type of isolation. Islands, and mountains within islands, are separated from each other within the Hawaiian chain. In the older, eroded islands, deep valleys provide shady wet pockets that are isolated from each other by dry ridges. Or, a forest may be separated into two quite distinct parts by a lava flow, with little intermingling between the resident species of each section.

The richly varied topography of the Hawaiian Islands provided opportunities for the successful colonists—opportunities that resulted in cycles of speciation. (Speciation refers to the process by which organisms differentiate into new species.) For example, the ancestors of a Hawaiian plant called the naenae (related to the tarweeds of California), originally came from dry mainland areas and probably established themselves on dry lava flats during their first years on the islands. Then over many years, the plants adapted to new localities as well. Because some naenaes *(Dubautia)* appeared on wetter slopes with shrubby vegetation, a species evolved with a shrub-like form and wide leaves, typical of cooler shrub forests. From those ancestors emerged a type a naenae with broader

The naenae's colonizing ancestors hailed from dry mainland sites, so Hawaii's lava flats were a suitable place to settle. While this shrubby naenae continues to thrive there, many new naenae species have emerged over time, each perfectly adapted to the distinct environment it inhabits.

leaves, suited to perpetually cloud-covered summits that receive muted light. This naenae also has a shorter stature to counter the shearing action of mountain winds. In the deep forests, a tree species with thin, broad leaves also developed. There is even a vining species of naenae.

A SECOND CYCLE of descendants emerged from the *Dubautia* ancestry: plants like the silversword (*Argyroxiphium*) and its close relatives, which are suited to the Hawaiian mountains. The features of the Haleakala silversword mirror its adaptation to the high, dry, cool, and intensely sunny cinder cones and crater of Haleakala, chief mountain of the Island of Maui. The leaves bear a covering of shining hairs that reflect ultraviolet light, thereby protecting the plant from damage. The dense rosettes of leaves are stemless, keeping the plants close to the ground to safeguard the growing bud in the center from frost. Also, the leaves are succulent, suited to the dryness and elevations (above 7,000 feet) of the crater. Sometimes growing six feet tall, the flower stalks of this silversword are covered with massive clusters of purple flowerheads, which are coated with bitter, tarry resins to repel hungry insects. Until Haleakala National Park was created, the mountain's silversword was very close to extinction.

By contrast, the Kau silversword has short woody stems because it grows on a ridge of Mauna Loa (a volcano on the Island of Hawaii) where threatening frosts do not occur. The Puu Kukui silversword lives on Puu Kukui (Maui's other mountain, second in size to Haleakala), where bogs surround the 5,800-foot summit. The bogs are perpetually mist-filled, so that even "normal" flowers would fill with rain. To avoid this problem, the Puu Kukui silversword bears its flowerheads in an inverted position. The Puu Kukui greensword forms succulent low shrubs at the margins of the same bogs and thereby avoids competition with the mountain's silversword.

A step removed from the silverswords and the greensword, the iliau *(Wilkesia gymnoxiphium)* lives below 4,000 feet on the Island of Kauai. Since frost poses no problem for this plant, it bears a crown of thin leaves on a pole-like stem. The length of the stem is the clue to its adaptation: the iliau equals the height of surrounding shrubbery and thus competes much better than it could were it short-stemmed.

Latter-day descendants of a single colonizing plant group (the same group from which the naenaes are descended), these species have fashioned themselves for survival in very different environments. Top: the Haleakala silversword, suited to dry, cool heights; above, the Puu Kukui greensword, which hugs moist bog margins; right, the iliau (a relative once removed), whose long stems reach for sunlit levels of its scrubby forest home.

The naenaes, the silverswords, the greensword, and the iliau are the descendants of one ancestral plant group that colonized the Hawaiian Islands. The process of a *single* group diversifying to this extent—where progeny resemble quite unrelated species—is called adaptive radiation. The term also describes the way in which one group adapts to a broad range of situations or ecological niches, rather than to a few special ones. The islands composing Hawaii are museums of adaptive radiation.

BESIDES THE PLANTS already described, the most often cited illustrations of adaptive radiation are Hawaii's honeycreepers *(Drepanidae).* These small native birds must have originated from a single colonization, long ago. Because of their early arrival and their spectacular success, the honeycreepers prevented other bird groups from radiating in the Hawaiian forests. In addition, they exploited a wide range of niches in the islands' forests.

The very first Hawaiian honeycreepers appear to have been curved-beaked birds that fed on nectar and a few insects. From this ancestry emerged many species and subspecies of honeycreepers with an amazing range of beak shapes and sizes, each perfectly matched to the feeding habits of a species. For nectar feeding, the long, tapering curved bill of the Kauai 'akialoa allows the bird to probe deeply into flowers. At the other extreme, are the parrot-beaked honeycreepers, such as the palila. With their short, heavy bills, these birds can crack large seeds or break thick twigs so as to yield the insects nestled inside. The short, straight beak of *Ciridops,* now extinct, is believed to have been adapted for a diet of palm fruits.

Most of the honeycreepers, however, became insect-hunters. The lengths of the beaks of each of the honeycreeper species are suited to the types of insects sought. Short bills are ideal for grasping insects on the surfaces of plants; medium-length beaks for catching insects in shallow recesses; longer, more slender bills for probing into crevices of bark or sifting through forest litter for insects. The evolution—and adaptive radiation—of insect-eating honeycreepers can be directly linked to the abundance of Hawaiian insects and the variety of places where they could be found, as well as to the absence of competing birds.

In *Origin of Species,* Charles Darwin reported the existence of a high number of flightless insects (mostly bettles) on the Island of Madeira in the Atlantic. If Darwin had known about and observed Hawaiian insects, he would have seen this phenomenon even more dramatically displayed. There were even two flightless native Hawaiian birds, both rails—and both now extinct.

WHY HAVE SO MANY flightless insects evolved on the islands? One idea is that wingless or very small-winged insects are less likely to be blown off an island and out to sea. Though this is an appealing thought, the groups of Hawaiian insects that are wingless or nearly so are not large-winged species—like moths or butterflies—that would ever be in danger of blowing away. Rather, the flightless insects belong to groups similar to beetles, which live in deep, breezeless areas within the forest canopy. The best explanation for the insects' inability to fly is related to their feeding habits. If a beetle can secure sufficient food (usually plant materials) by simply crawling from branch to branch or along the ground, flying becomes unnecessary. And though flight would be needed to evade predators, many typical mainland predators were missing from the Hawaiian Islands when the flightless insects were evolving.

Hawaii's two rails emerged as flightless species for much the same reasons as the insects. They walked along the ground choosing wisps of vegetation, a feeding habit typical of rails everywhere. In addition, predators were absent. Consequently, the Hawaiian rails did not need to fly either to feed or to avoid being fed upon. Flight involves an extensive output of energy. When it is no longer required, species with shorter wings will fare better than their fully winged relatives. The Hawaiian rail and the Laysan rail disappeared because humans introduced rats and mongooses, which fed upon the birds' eggs.

VERY INTERESTINGLY, there is a plant counterpart to flightlessness: the loss of dispersal mechanisms in fruits and seeds. An excel-

The brown lacewing, one of Hawaii's flightless native insects. Its name belies the heavy, shell-like wings.

lent example of this phenomenon is the fruit of a Hawaiian plant called the kokoolau *(Bidens)*, related to the common beggar tick or Spanish needle of America. In most parts of the world, the dry fruits of *Bidens* are slender—about an inch long—and tipped with prong-like structures that also bear downwardly pointing hairs like barbs. The body of the fruit itself is covered with upwardly pointing hairs. No matter which way the fruit becomes lodged in the feathers of a bird, it will remain there until the bird preens. (This, of course, explains how the first *Bidens* species arrived on the Hawaiian Islands.) But the fruits of various Hawaiian kokoolau plants have evolved different versions of these dispersal mechanisms: some are intact, some are quite degraded, and others have been lost altogether. For example, inland species of Hawaiian *Bidens* bear streamlined fruits: the prongs, hairs, and barbs are gone. Thus the fruits are unlikely to hitch a ride on a bird. Instead they remain pocketed where they are, not spreading. The fruits fall near the parent plants and grow successfully. On the other hand, the fruits of the kokoolau found on seabluffs of the Hawaiian Islands are still much like their ancestors because they continue to be dispersed by seabirds. Since the birds rarely carry the fruits inland, this *Bidens* plant occurs only in coastal areas.

A few kokoolau species have fruits that are not only smooth but large as well. This may be an adaptation to forest habitats. The larger fruit contains a bigger seed with more food reserves to nourish the seedling and permit it to grow until it reaches a better-lit level in the forest. With adequate sunlight, the seedling can then make enough food to survive. The weight of the larger fruits of these *Bidens* species further hinders their dispersal abilities.

THROUGH SPECIATION and unique adaptations to a variety of habitats and ecological niches, the first plants and animals to colonize the Hawaiian Islands have produced a wide array of unusual species. Many of these species exist nowhere else in the world—they are endemic only to the Hawaiian archipelago. Excluding those plants and animals introduced by humans, 100 percent of the islands' forest birds exist nowhere else: nearly 100 percent of the insects and land snails are endemic; and about 95 percent of the flowering plants and 65 percent of the ferns are endemic. (The percentages drop for other plant groups—such as mosses, algae, and fungi—because they have exceptionally good dispersal abilities. All of these three plant groups reproduce by minute spores that can easily travel around the world.) Endemism is not only a measure of the great opportunity that existed for living things to diversify on the islands; it is also a measure of Hawaii's isolation.

That many types of organisms can live in the Hawaiian Islands is apparent from the many instances in which species have been introduced into the islands and have then established themselves in the wild. Nonetheless, the number of different *kinds* of plants and animals that arrived in the years before human settlement is actually fairly small. The absent kinds are those that are poor dispersers. For example, the seeds of pines and other conifers are too large to be carried by birds, and they cannot float in seawater. Also they are killed by saltwater. Compared to most plants and birds, mammals are quite poor at dispersal, as they are not known to cross straits of saltwater any more than a few miles wide. Therefore, the Hawaiian hoary bat is the only mammal, save humans, to have reached the archipelago.

DURING THE YEARS prior to human settlement on the Hawaiian Islands, the native flora and fauna evolved and flourished in lands where competitors were scarce and great herds of herbivorous mammals were absent. Continental plants, on the other hand, evolved alongside cows, sheep, goats, deer, pigs, rabbits, and mice. To resist being eaten or trampled, these plants developed various kinds of protective qualities: poisonous or bad-tasting chemicals, rough textured barks, hairs that emit unpleasant oily scents, and spiny armaments like thorns and needles. The plants of the Hawaiian Islands, however, gradually lost these devices and structures. Members of the mint family are universally thought to have strong oily scents, which repel browsing animals. Yet these odors are absent in the Hawaiian mints. There is even a Hawaiian raspberry that has no thorns. Of all the native flora, only one plant is known to have poisonous leaves and stems; a second has poisonous roots.

Lacking protective qualities, the islands' flora is defenseless against browsing and trampling animals. When pigs, goats, sheep, deer, and other mammals were introduced into the Hawaiian Islands, the plants had no means of resisting. Many of these mammals still roam wild, more troublesome in some areas than in others. But when the animals are removed, the native flora recovers rather well. The silversword of Haleakala has been scarce for many years because of the goats that wander the mountain. When rangers of Haleakala National Park fenced in a few acres of land so that goats could not enter, the silverswords began to

For want of weapons (poisons, offensive odors, thorns), Hawaii's native plants are largely defenseless against introduced herbivores. This fenced-in tract in Haleakala National Park on Maui offers the beleaguered silversword a habitat free from the browsing and trampling of resident goats.

flourish there, giving a hint of the shimmering plant cover that once ringed the volcano.

Hawaiian animals also are threatened by exotic species. The introduced mongoose endangers birds whose eggs can be easily located and eaten. Rats have undoubtedly killed many honeycreepers. A strange, indirect cause of extinction is bird malaria, which weakens flocks of honeycreepers by causing their claws to swell. The disease infected Hawaiian birds only after the introduction of mosquitos.

DESPITE THE VULNERABILITY of Hawaiian plants and animals, conservation efforts are indicating that when protective measures are taken, most of the species in a particular area can be saved. The long list of endangered and threatened species in the islands should not be interpreted as a reason for pessimism, because the list also reflects the high numbers of plants and animals endemic to Hawaii. Actually, since native species are so numerous, conservation efforts in Hawaii could well save a multitude of imperiled forms of life.

The Hawaiian Islands are like a series of remote laboratories devoted to intricate biological experiments. Their isolation, ideal climate, and varied geology and topography combined to permit the emergence of an unparalleled array of endemic species. By taking curious and unexpected courses of evolution, the colonizing plants and animals of the islands developed over millions of years into the most exciting and astonishing flora and fauna to be found on an archipelago of oceanic islands. Each species displays the unusual qualities that enabled it to adapt and survive, making the Hawaiian Islands a vast museum of island evolution.

Professor of Botany at Claremont Graduate School and Pomona College in Claremont, California, **Sherwin Carlquist** is the author of three books about island evolution: *Island Life; Island Biology;* and *Hawaii, a Natural History*. His prime field of research, however, is in plant anatomy. Two other books and most of his 100 scientific papers deal with the structure of plants.

Saving an Aerial Legacy

by John Simpson

IN 1907 A YOUNG WRITER named Jack London fulfilled a lifelong dream of journeying to the South Seas. He sailed into Hawaiian waters in May of that year and was so captivated by the islands that he returned there twice again to write many of his well-known tales. Of Hawaii, London exclaimed that the American people "don't know what they've got! Just watch this land in the future when once Americans wake up!"

In one sense London's prophecy has long since been realized. Americans have awakened to the beauty of the Hawaiian Islands and so has the rest of the world. Each year millions of visitors travel to the planet's most isolated land mass in search of famed tropical beaches, spectacular scenery, and Polynesian hospitality. Moreover, many people have chosen to live in Hawaii, creating a remarkable mixture of cultures.

Regrettably, in another sense, London's predicted awakening has not occurred. Few visitors or residents recognize that there exists another Hawaii, one too often unnoticed, yet perhaps more unusual and irreplaceable than Hawaii's traditional attractions. Here on one of the Earth's evolutionary showcases has emerged an extraordinary array of plants and animals, some 96 percent of which exist nowhere else.

Much of this great biological wealth has been destroyed. If the significance of the islands' endemic species is not acknowledged, the chance of saving the native plants and animals that remain is greatly diminished. What is needed is a "second awakening"—one that goes beyond just appreciating Hawaii's scenic and cultural delights and tourist pleasures.

ONE OF THE MOST remarkable components of Hawaii's natural treasures is the endemic bird life. Because inhabitation of the islands came about largely by chance, relatively few kinds of birds successfully established themselves. Yet from as few as 15 colonizing species, more than 70 different species and subspecies of birds evolved on the Hawaiian Islands. This native avifauna includes a hawk, an owl, a goose, a crow, two thrushes, an old-world warbler, an old-world flycatcher, and an entire family of small finch-like birds, known as the Hawaiian honeycreepers. The 47 kinds of honey-

The 'i'iwi.

The 'elepaio.

The 'amakihi.

creepers may have issued from a single ancestral species.

But despite their initial adaptability to the islands, Hawaii's endemic birds have disappeared at a drastic rate. Of the original 70 forms known to exist in the islands when Captain Cook arrived in 1778, 23 have become extinct; 30 are classified as endangered, 1 more as threatened. Currently only 16 are represented by viable populations. Perhaps the 58 kinds of forest birds have suffered most: 21 of the 23 extinct species or subspecies inhabited the Hawaiian forests; another 21 are endangered. Almost *half* the birds listed by the U.S. Fish and Wildlife Service as threatened or endangered in the United States are endemic to Hawaii. In fact, more birds are threatened with extinction in the Hawaiian Islands than in any other area of similar size on Earth.

And the loss continues. For example, just a few years ago, there were believed to be only six pairs of Kauai 'o'o remaining on the island. A pair seen in 1981 by an ornithologist may have been the last one in existence. A significant part of the islands' rich natural history—and of the world's vital biological stock—is slipping into the past. Steps had to be taken to save the remaining forest birds.

Because of the inaccessibility of Hawaii's forests, little was known until recently about the islands' avifauna. Alarmed by this lack of information and by the possibility of further extinctions, the U.S. Fish and Wildlife Service—in cooperation with state, private, and other federal agencies—in 1975 initiated an extensive survey of Hawaii's forest bird populations. During the next six years, the numbers of birds heard and seen were recorded at 9,600 separate observation sites on the islands of Hawaii, Maui, Molokai, and Kauai. The resulting Fish and Wildlife Service recovery plans described the communities, numbers, and distributions of the endangered forest birds, as well as the various threats to those populations. The plans also delineated essential forest bird habitats and recommended land management programs and additional research to preserve the habitats. Reasons for the decline in populations of endemic Hawaiian avifauna are complex and not always well understood. Habitat degradation or destruction and avian diseases are believed to be the primary causes of extinction,

A triumvirate of honeycreepers: above, the crested honeycreeper or 'akohekohe; right, the Hawaiian creeper; opposite, the 'apapane.

but competition from exotic birds and insects, predation, and collection are also cited.

For example, in just over 20 years, more than 40,000 acres of native forests have been cleared. Over 170 foreign bird species, which are vectors for diseases and competitors for habitats, have been brought to the islands. The forest ecosystems also continue to be degraded by feral pigs, goats, and cattle, all introduced. These foraging, trampling animals are then followed by invading exotic plants—such as the hardy strawberry guava—which take root and flourish in areas where the native forest understories have been disrupted. Another threatening plant, the banana poka is an ornamental vine that was brought to the Hawaiian Islands just a few decades ago. The plant escaped to the forest where—resembling a scene from a science fiction film—it has aggressively climbed and collapsed entire groves of trees, killing all the understory as well.

THE FOREST BIRDS particularly affected by human impact on the islands are the diverse Hawaiian honeycreepers. Forty-seven species and subspecies were believed to inhabit Hawaii in 1778. Since then, 15 have been extirpated and 16 are classified as endangered. Island-wide extinction of the 'i'iwi has already occurred on Lanai, and the

crested honeycreeper is gone from Molokai. The 'akialoa has disappeared from all three of the islands it once inhabited, while the Kauai 'akialoa was last seen in 1973. Species extinction in Hawaii is an immediate threat that will not wait for preservation efforts.

Perpetuating and restoring endangered bird habitat is a complex task, yet The Nature Conservancy is endeavoring to "tip the fragile balance" in favor of Hawaii's forests and their imperiled birds. With the surveys completed by the U.S. Fish and Wildlife Service and the concern of Hawaiian citizens, the Conservancy had excellent tools with which to begin its work.

In 1980—with assistance from the Conservancy's national office—Hawaiian landowners, scientists and community and business leaders formed The Nature Conservancy of Hawaii and launched the Endangered Hawaiian Forest Bird Project. A volunteer board of trustees was established, and a local professional staff was hired and trained.

The goal of the Endangered Hawaiian Forest Bird Project is to assist the people and government agencies of Hawaii in establishing and maintaining a network of preserves that will ensure the survival of each of Hawaii's endangered forest bird species. The Fish and Wildlife surveys were used to identify the best potential sanctuaries on the islands of Hawaii, Molokai, Maui, and Kauai, where 19 of the 21 endangered forest birds are found. (Nearly all the areas targeted for protection under the project adjoin existing publicly owned lands, such as state parks and refuges, or some properties already preserved by the Conservancy.) The Nature Conservancy of Hawaii has initiated a wide range of cooperative protection and land management programs to safeguard avian residents on those four islands.

To date, the principal achievement of the Endangered Hawaiian Forest Bird Project is having secured an option on a conservation easement that will protect land in the proposed Kamakou Pre-

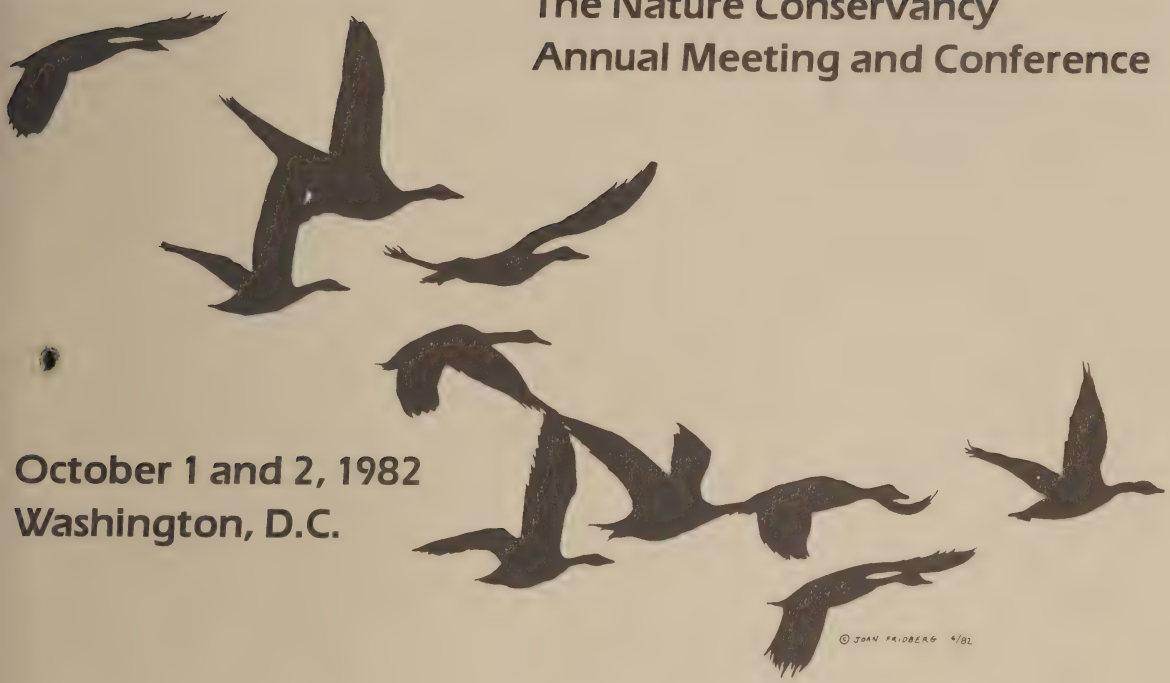
The Kauai 'o'o.

serve on Molokai. The island contains a mountainous remnant of rain forest that harbors two imperiled forest birds, as well as native plant and insect species. In September 1981 Molokai Ranch, Limited, extended an option to the Conservancy to purchase a perpetual conservation easement encompassing 2,700 acres of this critical habitat. The option must be exercised in July 1982. The easement agreement will benefit both the owners of the parcel and the resident forest birds. While Molokai Ranch, Limited, will retain ownership of the property—which contains a vital watershed for the ranch's agricultural lands—the Conservancy will maintain the ecosystem, thereby protecting both the native species and the watershed. Management plans for the Kamakou Preserve include reducing the impact of feral pigs and controlling the spread of exotic plants.

"Operation Shades" is another cooperative venture of the Endangered Hawaiian Forest Bird Project. The 'a'o, or Newell's shearwater, is a seabird that nests on the forested slopes of Kauai. In fall months, the fledgling 'a'os suffer from a perplexing problem called "autumnal fallout." Because the young birds are highly attracted to artificial lights, they collide with city street and building lights as they fly from their nests to the sea. As many as 1,000 'a'os are injured each year, and the mortality rate is high. The Nature Conservancy of Hawaii is currently working with the Fish and Wildlife Service and Kauai Electric to install shades on the island's street lamps. Meanwhile, other private groups have created aid stations around the islands to nurse injured birds. The Conservancy also is seeking to protect an 'a'o nesting site from predators like cats, rats, and mongooses.

THE CONSERVANCY'S OLDEST and most prodigious Hawaiian endeavor has centered on Maui's Kipahulu Valley, where the organization purchased 4,625 acres in 1969. Stretching from Haleakala National Park to the southeastern shoreline of the Island of Maui, the valley encompasses native koa and 'ohi'a forests that are a refuge for four endangered honeycreepers: the Maui nukupu'u, the crested honeycreeper, the Maui 'akepa, and the Maui parrotbill. The Conservancy and the State of Hawaii jointly conveyed the upper Kipahulu Valley to the National Park Service as an extension of Haleakala National Park. But the Conservancy still owns interests in approximately 1,000 acres in the lower valley, portions of which serve as a protective buffer for the park land above. Here in the lowlands, the organization has been working with local residents to foster compatible agricultural and ranching practices that will not

The Nature Conservancy
Annual Meeting and Conference



October 1 and 2, 1982
Washington, D.C.

Washington, D.C., Friday, October 1 —Housing permanent collections of tropical, subtropical, and desert plants under 29,000 square feet of glass, the National Botanical Gardens will be the site of the meeting's Opening Reception—a celebration of the Conservancy's regional diversity.

Washington, D.C., Saturday, October 2 — Conservancy members and guests are invited to sit in on open committee meetings of the organization's national Board of Governors to experience firsthand the forum in which decisions on the Conservancy's policies of identification, protection, and stewardship are made. Also during the morning, films on the Conservancy's Rivers of the Deep South and California Critical Areas Programs will be screened.

The Annual Membership Meeting of the Conservancy, highlighted by President Bill Blair's slide-illustrated report to the members on the organization's recent accomplishments, will follow lunch.

In the afternoon, three field trips to sites of interest in the nation's capital—the National Zoological Park, the National Arboretum, and Dumbarton Oaks — will be offered. Members may decide instead to tour one of the museums of the prestigious Smithsonian Institution (some as close as five blocks to the headquarters hotel).

The Annual Meeting and Conference will close with the Annual Awards Banquet—an opportunity to recognize a few of the Conservancy's many dedicated volunteers and to hear a national leader in conservation policy, The Honorable James Buckley, under secretary of state for security assistance, science & technology and former senator from New York.

After the meeting, members may elect to tour one of the Conservancy's most splendid projects in the Mid-Atlantic region: the Virginia Coast Reserve or South Cape May Meadows, New Jersey.

Hotel

The headquarters hotel for the Conservancy's Annual Meeting and Conference, Loews L'Enfant Plaza, is located within ten blocks of the Capitol, the National Botanical Gardens, the Potomac Waterfront, and the Smithsonian Institution. A station of the District of Columbia's Metrorail system links the hotel with National Airport, downtown, Union Station, and the Conservancy's national office. A block of rooms has been reserved for Thursday, September 30, through Sunday, October 3, at special rates. To make reservations, you must return the card (see next page) directly to Loews L'Enfant Plaza Hotel before September 9, 1982.

HOTEL REGISTRATION CARD

Loews L'Enfant Plaza Hotel (202) 484-1000

The Nature Conservancy
Annual Meeting and Conference
October 1 and 2, 1982

Name _____

Street _____

City _____ State _____ Zip _____

Telephone _____ Sharing with _____

Arrival date _____ Departure date _____

Reservations are not transferrable and are held until 6:00 PM unless guaranteed by one of the following:

☐ American Express Card # _____

☐ Diners Club Card# _____

Expiration date _____

☐ Advanced deposit (one night) $ _____

Failure to cancel by 6:00 PM the day of arrival will result in one night's charges.

Room Type	Group Rates
☐ Single (1 person)	$70.00*
☐ Double (2 people)	$80.00*
☐ Double/Double (2 beds, 2 people)	$80.00*

*plus D. C. occupancy and sales tax

Rooms may not be available for occupancy until after 3:00 PM. Check-out time is 1:00 PM.

Reservations received after September 9, 1981, will be confirmed on a space available basis.

Mail this card directly to: Reservation Manager, Loews L'Enfant Plaza Hotel, 480 L'Enfant Plaza, S. W., Washington, D. C. 20024

Post-Conference Field Trips

The Virginia Coast Reserve, our nation's last chain of undeveloped barrier islands, stretches from the Maryland/Virginia border south to the mouth of the Chesapeake Bay. On Sunday, October 3, a Conservancy group will travel to the coast to visit Parramore, the largest of the Conservancy's thirteen islands, after pausing on the way at Blackwater National Wildlife Refuge (for which the Conservancy has acquired almost 3,000 acres). Later, trip participants will enjoy a feast of the area's best known delicacy, Chesapeake Bay blue crab. Breakfasting early on Monday, October 4, the adventurers will board the good ship Jennifer in historic Wachapreague, arriving at Parramore Island by mid-morning. Birding, beachcombing, and bathing (sun and surf) will be the orders of the day on Parramore, with a break for a sack lunch near the docks of a Coast Guard station. Brownsville, a recently restored castor bean plantation home that serves as headquarters for the Reserve, will welcome the weary travelers with a fish fry on Monday evening. Up at dawn on Tuesday, October 5, the travelers will return to Washington's National Airport by 1:00 p.m.

Roger Tory Peterson has called **South Cape May Meadows** in New Jersey "one of the country's outstanding bird-watching areas." Recognizing this, the Conservancy recently secured a 180-acre sanctuary here through a gift by Combustion Engineering, Inc. Thousands of raptors, multitudes of songbirds, shorebirds, and waterfowl migrate across Cape May each fall, pausing to rest and feed here before passing over Delaware Bay. Departing Sunday, October 3, a second group from the Conservancy will take the Cape May-Lewes Ferry across the Bay to Cape May. A national historic landmark city, America's oldest seashore resort features many homes, hotels, shops, and other buildings constructed in the late 1800s—the heyday of Victorian life. Accommodations have been arranged in three of the city's most authentically restored guest houses, and an historic tour will be offered. Sunday, October 3, and Monday, October 4, offer visitors a grand opportunity to be at the best spot on the East Coast for birdwatching—assisted by leaders from the locally headquartered New Jersey Audubon Society. This tour also will return to Washington's National Airport by 3:00 p.m. on Tuesday, October 5.

The cost for either tour will be $125.00 per person. This includes two breakfasts, two lunches, one dinner, bus transportation (and boat transportation for the Virginia Coast Reserve trip). Accommodations are additional as indicated on the registration form. Space is available on a first-come/first-served basis.

Date _____ REGIS. # _____

Check # _____
Amount _____
Balance Due _____
Refund Due _____

ABOVE AREA FOR OFFICIAL USE ONLY

REGISTRATION FORM

NAME(S) _____
(print name to appear on badge)

ADDRESS _____
Street City State Zip

TELEPHONE (residence) _____ (business) _____

CHAPTER _____

Membership or special classification:

- ☐ Conservancy member
- ☐ Governor Emeritus
- ☐ Board member
- ☐ Speaker
- ☐ Chapter trustee
- ☐ Staff member
- ☐ Life member
- ☐ Chapter chairman

Special requests:

☐ No meat diet ☐ Other

Events and Field Trips

Event	Fee per person	Attendees	Cost
Friday, October 1			
Opening Reception	included in registration fee	_____	N/A
Saturday, October 2			
Continental Breakfast	included in registration fee	_____	N/A
Annual Meeting Luncheon	included in registration fee	_____	N/A
Afternoon Field Trips:			
National Zoological Park	$10.00 X	_____ =	_____
National Arboretum	$10.00 X	_____ =	_____
Dumbarton Oaks	$10.00 X	_____ =	_____
Annual Awards Banquet	included in registration fee	_____	N/A

(continued on next page)

Event	Fee per person	Attendees	Cost
Sunday, October 3- Tuesday, October 5			
Post-conference Tour Virginia Coast Reserve	$125.00 X	_____ =	_____
Accommodations: (two nights)	single ..... $75.00 X double (per person) ..... $45.00 X twins (per person) ..... $45.00 X	_____ =	_____

(Trip includes three breakfasts, one crab feast, one bag lunch, one fish fry, bus and boat transportation.)

Post-conference Tour Cape May, New Jersey	$125.00 X	_____ =	_____
Accommodations: (two nights)	single, private bath ..... $110.00 X single, shared bath ..... $ 90.00 X double, private bath ..... $ 65.00 X (per person) double, shared bath ..... $ 55.00 X twin, private bath ..... $ 65.00 X twin, shared bath ..... $ 55.00 X (per person)	_____ =	_____

Note: Due to the special nature of the accommodations in these very special Victorian guest houses, no two rooms are alike. Rooms will be assigned on a first-come/first-served basis.

(Trip includes three breakfasts, two lunches, one dinner, bus and ferry transportation, and assistance from guides familiar with the avian and historic highlights of the New Jersey Cape.)

Field trips subtotal ..... $_____

REGISTRATION FEE

Attendance at The Nature Conservancy Annual Meeting is limited to members and their families.

The registration fee is $125.00 per person. The fee includes the Opening Reception cocktail buffet, a continental breakfast, the Annual Meeting Luncheon, and the Annual Awards Banquet, as well as other general meeting costs incurred by the Conservancy. Due to the necessity to make advance guarantees and reservations, there will be no substitutions or reductions in the listed fees.

FULL REFUNDS will be made prior to September 1, 1982. NO FULL REFUNDS of the Annual Meeting Registration Fee and the Field Trip Fees will be made after that date. Only in cases of emergency, the reasons for which must be submitted in writing to the Annual Meeting Coordinator, will PARTIAL REFUNDS be made. A percentage will be retained to cover deposits and other meeting-related costs.

Registration subtotal @ $125.00 per person ..... $_____

Field trips subtotal ..... $_____

TOTAL AMOUNT ENCLOSED ..... $_____

Please make checks payable to The Nature Conservancy.

Please mail to: Annual Meeting Registrar
The Nature Conservancy
1800 N. Kent Street
Arlington, VA 22209

The 'akiapola'au.

The 'oma'o.

only help protect the upper valley, but preserve a rural Hawaiian way of life as well. In addition, techniques are being explored to reduce wild pigs and exotic plants in the area. To expand the Kipahulu Valley Preserve, the Conservancy has recently acquired two additional parcels totaling about 240 acres. A third tract of 140 acres has been optioned for purchase in early October 1982.

Through a variety of land protection and management programs, the Conservancy's Endangered Hawaiian Forest Bird Project is fostering the "second awakening" so essential to the survival of Hawaii's endemic forest birds and the fragile ecosystems they inhabit. But this innovative and vital conservation effort—like any other—requires funding, both to complete the Kipahulu Valley Preserve and to establish and manage the Kamakou Preserve and other critical areas like it. Recognizing the severity of species loss in the Hawaiian Islands, the New York-based Goodhill Foundation has pledged a $1 million challenge grant to the project. To match and thereby obtain this grant, The Nature Conservancy of Hawaii, with the help of the national organization, must raise an additional $2 million by December 31, 1983. The Conservancy hopes to receive half of these funds from the U.S. mainland and the other half from the citizens of Hawaii.

Nowhere else in the United States are as many native species facing possible extinction in the decade ahead as in the Hawaiian Islands. The forest birds of Hawaii are a most dramatic example of what may be lost . . . or of what may be saved.

John Simpson is a contributing editor of *Oahu Magazine* in Honolulu, Hawaii. He also has taught park and open-space planning at the University of Oregon and has worked as a consultant on urban park planning projects in the states of Hawaii, Washington, Oregon, and Colorado.

The Nature Conservancy in Hawaii

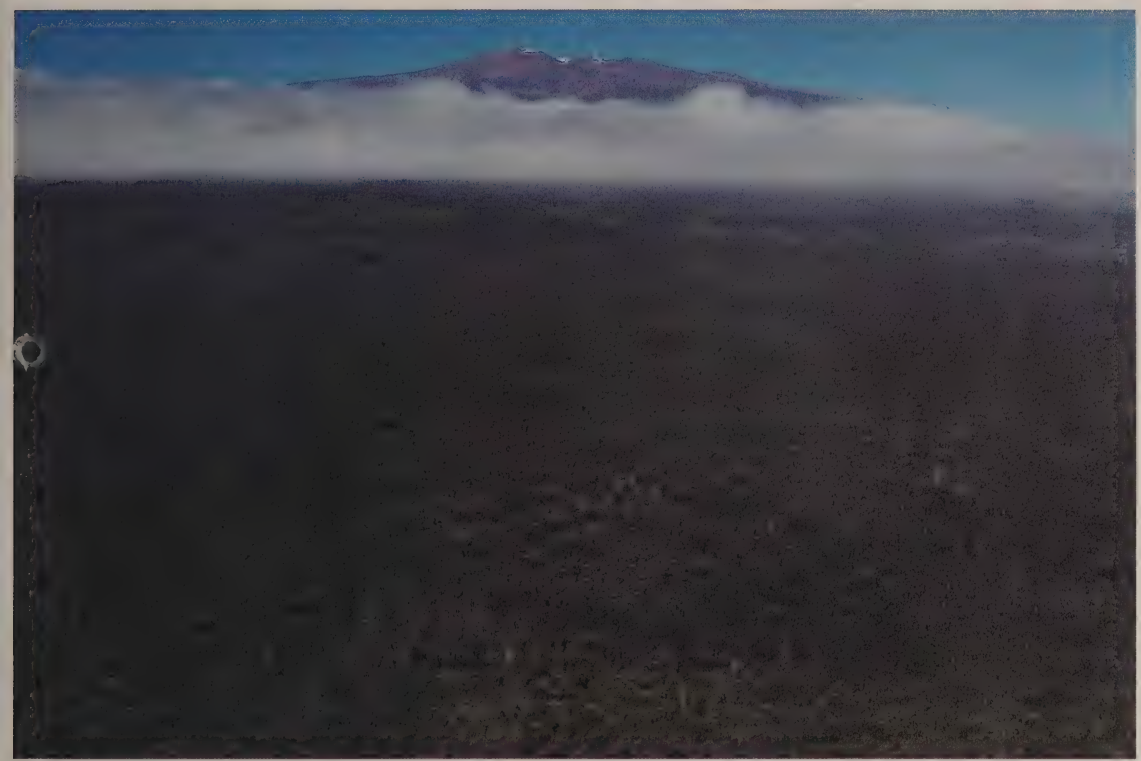
The Nature Conservancy's Endangered Hawaiian Forest Bird Project was created to assist the citizens of Hawaii in saving an irreplaceable element of the islands' native landscape. On the next six pages, the *News* presents a photo essay depicting three areas currently being safeguarded under the Endangered Hawaiian Forest Bird Project.

Hakalau Preserve

MAUNA KEA, which rises 13,796 feet above the Hamakua coastline of Hawaii Island, is the largest volcano in the Hawaiian chain. Blanketing part of its slopes is a 60,000-acre montane forest that stretches from about 3,000 feet to 6,500 feet. The ecosystem supports wetter 'ohi'a forests at lower elevations, dryer koa stands at the top, and a mixture of both native forests in the middle.

Extending from a height of about 5,500 feet down to 3,000 feet, the Conservancy's Hakalau Preserve is a 3,300-acre swatch of Mauna Kea's endangered koa-'ohi'a ecosystem. Often called the "monarchs of the Hawaiian forests," the stately koa trees in Hakalau's upper reaches attain trunk diameters of 4 to 6 feet. Below 4,000 feet, the 'ohi'a trees tower above the forest, their branches adorned with small round leaves and bright scarlet pompon-like blooms. Lower elevations support several rare plants, recently rediscovered, such as endemic lobeliads and the Hawaiian mint.

The montane koa and 'ohi'a forest of upper Hakalau is rich in native avifauna. The bird life includes three endangered honeycreepers: the Hawaiian creeper, the 'akiapola'au, and the Hawaii 'akepa. Also endangered, the 'io, or Hawaiian hawk, ranges over the entire Hakalau Preserve.



Above: Hawaii Island's Mauna Kea breaches the clouds; left, koa tree; opposite, the 'io or Hawaiian hawk, endangered throughout its range.

Kamakou Preserve

ONE OF THE relatively untouched places in Hawaii lies on the Island of Molokai and encompasses the areas of Lehu'ula, the Waikolu Plateau, Oloku'i, and the majestic valleys of Pelekunu and Wailau. The mountain ridges and steep slopes are richly clad in diverse native flora, which supports Molokai's endemic forest bird populations. Embracing approximately 18,000 acres, the land is largely wet 'ohi'a forest, the only ecosystem of this type left on the island.

Lying above the Pelekunu Valley, the proposed Kamakou Preserve is an outstanding part of the vital 'ohi'a forest ecosystem. The 2,700-acre sanctuary harbors the endangered Molokai oloma'o, or Hawaiian thrush, and possibly the endangered Molokai creeper, though it has not been seen in a number of years. Three other native birds, all honeycreepers, inhabit the preserve: the 'i'iwi, the 'apapane, and the 'amakihi. All depend upon the 'ohi'a forest for their survival. Named in honor of Molokai's highest peak, the Kamakou Preserve contains four distinct biological communities: the 'ohi'a forest, three small bog areas (rare in the islands), a series of intact lava tubes, and remnants of unusual mesic forest vegetation.

Clockwise from top left: the 'i'iwi, one of Kamakou's three native honeycreepers; view to Pelekunu Valley; the 'ohi'a tree's bold blossoms; waterfall and pool at Kamakou.

Kipahulu Valley Preserve

ON THE ISLAND OF MAUI, the Kipahulu Valley stretches from the 7,000-foot rim of the Haleakala crater to the shoreline at Kipahulu. Shrouded in mist and sprinkled with cascading waterfalls, the valley is surrounded by sheer cliffs, some reaching 1,500 feet in height. The upper valley, donated to the National Park Service in 1969 by the Conservancy and the State of Hawaii, ranges from subalpine shrubland at the top to a rich 'ohi'a forest below—and culminates in a mixture of koa and 'ohi'a trees. The scenic lower valley, still owned in large part by the Conservancy, consists largely of pastureland. Here streams cut the verdant hillsides before crashing into the lava coast below.

The Kipahulu Valley, like Kamakou and Hakalau, is a refuge for Hawaii's endangered forest birds. In 1967 the Conservancy sponsored a month-long trek into the remote valley. During the expedition, the Maui nukupuu, a small honeycreeper with a long down-curving bill used for extracting nectar from flowers, was rediscovered. It was believed to be extinct and had not been sighted for 71 years. Three other imperiled forest birds are found in the valley.

Opposite: Kipahulu, from the air. Clockwise from left: lower valley pools; amau ferns, on the ridge; the luxuriant upper valley, caught in clouds.

ECOLOGY FORUM

No. 44
by Francis G. Howarth, Entomologist
Bishop Museum, Honolulu

ADAPTIVE RADIATION AMONG HAWAIIAN INSECTS

In order to reach the Hawaiian Islands—strung out in mid-ocean, 2,500 miles from the nearest continent—land animals and plants had to swim, float, fly (or hitchhike on an animal that could). It is not surprising, then, that apart from humans, bats were the only land mammals to find their own way there.

The dominant "consumer groups" in Hawaii, as on oceanic islands generally, are birds, insects and their relatives, and molluscs. All of these are groups that can disperse and adapt to isolated environments; and because insects have been the most successful at this, they play a major role in the functioning of island ecosystems.

Having won the dispersal sweepstakes, many insects adapted to Hawaiian habitats and new life styles by evolving into numerous closely related species. Because this process of adaptive radiation is everywhere in evidence, Hawaii is one of the best spots in the world for studying insect adaptation and ecology.

Not every insect group made it to prehistoric Hawaii. Actually, less than 15 percent of the living families of insects are represented on the islands, a fact that underscores the incredible isolation that shaped the islands' biota. Fewer than 300 colonizing insect species account for the 7,000 or so native species in Hawaii. That is, fewer than 300 ancestor species have been parlayed, through adaptive radiation, into 7,000 descendant species.

The pomace or "fruit" fly family (*Drosophilidae*), one of the most successful insect groups in Hawaii, has been the subject of a highly significant multidisciplinary study during the past 20 years (conducted under the direction of D. Elmo Hardy, Hampton Carson, and associates at the University of Hawaii). The common pomace fly, *Drosophila melanogaster,* is an animal of choice for genetic research. By fortuitous happenstance a *D. melanogaster*-like fly vacationed in Hawaii a few million years ago and, like many present-day tourists, decided to stay on. The flies flourished and adapted to new habitats as they successfully colonized the newer islands of Kauai, Oahu, Maui, and Hawaii as each formed (in succession) at the southeast end of the chain.

Today's Hawaiian pomace flies represent one of the finest examples of adaptive radiation. More than 500 identified pomace fly species—all descended from one or two immigrant ancestors—have evolved to occupy the islands' many distinct niches. (It's estimated that there will be 1,000 when native fauna is better known.) And there are some 298 other spectacular examples of adaptive radiation among Hawaiian insects and their relatives, many offering insights into complex life processes.

A recurrent and conspicuous phenomenon among the adaptively radiating insect groups in Hawaii is the evolution of flightlessness. There are, for example, flightless beetle-like lacewings, flightless crickets, moths, and beetles, and stubby-winged and wingless true bugs and planthoppers. However, flightlessness itself is not a phenomenon of islands alone. One need look no further than one's front yard to find highly successful flightless insects. These include the springtails, silverfish, scale insects, ants, termites, and some cockroaches—to mention only a few continental groups. Some of these have flighted dispersal stages, but the point to remember is that nearly all insects spend the major part of their active lives as flightless creatures (like the butterfly caterpillar). In most ecosystems selection pressures allow exploitation of numerous niches by flightless animals.

Since most of the dominant flightless continental groups didn't make it to Hawaii (for obvious reasons), many of the *flighted* Hawaiian natives have adapted to fill roles played by *flightless* insects on the continents. This is precisely what makes Hawaii in particular, and oceanic islands in general, so exciting for the study of flightlessness among insects. Selection pressures and evolutionary processes are similar on continents and islands; but be-

cause oceanic islands like Hawaii are younger and have had a less complex geological history than most continental habitats, the evolutionary stages can be seen more clearly. For one thing, close relatives often coexist on the islands, and this allows scientists to compare similar species that have adapted differently to exploit different resources or niches.

In a way, each island is a mini-continent, where communities and ecosystems have evolved independently—oftentimes from the same stock as on nearby islands, sometimes from different immigrants. It is as if a variety of teams have played the same game with the same rules—but with different players on each island. Or, where the same species has dispersed to two separate islands and an adaptive shift has occurred, it's as if the same game has been played by the same player—but with different rules.

For instance, the cixiid planthoppers contain a large group of native sap-sucking bugs. Most of the 80 or so species have large bulging eyes, well-developed functional wings, and bold but cryptic (concealing) coloration. But on Hawaii Island there is a blind, white, flightless species that lives only underground, feeding on the roots of the native ohia tree. It is so modified for its subterranean life that it looks, at first glance, as if it's unrelated to the surface-dwelling planthoppers. However, close analysis of the fundamental characteristics used in insect classification shows that apart from its subterranean characteristics, it is virtually indistinguishable from a fully eyed, flighted rain-forest planthopper that also lives on Hawaii and feeds on ohia roots.

Given the age of the Island of Hawaii, estimated at 400,000 to 700,000 years, the degree of modification represented in this adaptive shift among cixiid planthoppers is remarkable. Interestingly, there is a second subterranean planthopper that sucks the sap of ohia tree roots and lives in only a small wooded area on Maui. Superficially, the two underground species are close look-alikes; but the Maui species evolved independently from a separate ancestor—one only distantly related to the Hawaii Island species pair. In other words, the same modification occurred twice, as two distinct founding planthopper species made nearly identical adaptive shifts. The surprising adaptational convergence—the independent but similar evolutionary development—displayed by these two underground species might have gone forever undetected since the underground fauna of Hawaii was only recently discovered, and many of its species (particularly on the older islands) are threatened with extinction through habitat destruction.

Another flightless insect is a grasshopper-like moth that lives only on the summit of Haleakala, the largest volcanic mountain on Maui. It is unusual among moths in that both sexes are flightless. It was long assumed that certain mountaintop species were flightless because a flighted species could be blown away in a barren, windy environment. We now know that their flightlessness is connected to their feeding habits. The caterpillar of the flightless grasshopper-like moth feeds on wind-borne organic debris trapped under loose rocks, and in cracks and other irregularities near the summit. To find these deposits for their caterpillars, the adults *mimic* the food resource: they jump into the wind and weakly flutter, blowing across the summit to be trapped in the same rocky shelters as the wind-borne organic debris. In this way, the reduction of its wings has allowed the insect to exploit its habitat more efficiently. Far from being a fragil island endemic, as was once assumed, this species is admirably evolved to thrive in its environment. Its closest relative is flighted and lives in nearby forests on Haleakala. The caterpillar of this species scavenges under loose tree bark. A distant relative that independently evolved as a flightless creature was recently discovered in a similar environment on the slopes of Hawaii Island's Mauna Kea.

Many insects—and all of the other native arthropod groups—arrived in Hawaii without the power of flight. A number of these flightless colonizers were marine, living in the ocean or along the coast. Among them, springtails, a firebrat, a few crickets, flies, earwigs, beetles and true bugs came to the islands by ocean voyaging. Once established on Hawaii's shores, some of these species were able to adapt to freshwater and even to inland terrestrial habitats such as rain forests.

Among the other arthropods, a centipede and a few sandhoppers came to Hawaii by ocean. The *Amphipoda,* a large order of crustaceans, is predominantly marine but includes many freshwater species. Only one small family, the *Talitridae,* has been more or less successful in colonizing terrestrial habitats. Most of the 100 or so known species of these sandpipers inhabit coastal beaches and littoral zones around the world. They were early colonists in Hawaii and managed to invade many terrestrial habitats. At present, more than 30 species are known from Hawaiian forests. Some live in mosses and liverworts on tree trunks, in leaf-litter on the ground, in the damp litter of leaf axils, and in trees. One large showy sandhopper bores into steams of greenswords in high-altitude bogs within The Nature Conservancy's Kipahulu Valley Preserve. This is unusual since the bogs occur at 8,000 feet, where frost is common. The

mountainous location is a far cry from the insect's ancestral beach habitats. The most extraordinary *Talitridae* family member—a large, terrestrial, totally blind species that lives in caves in a tiny, unprotected area on Kauai—is threatened with extinction.

The survival of Hawaii's insects, not to mention its native plants and its other native animals, is generally imperiled. Human activity has broken the splendid isolation that fashioned these island environments. The most insidious threat is biological pollution— the introduction of exotic species into Hawaii's ecosystems. Once entrenched, introduced species are exceedingly difficult to eradicate. For example, at this writing, a plan to rid the islands of their three species of *introduced* fruit flies, including the Mediterranean, may involve massive spraying of pesticide over most of the islands' ecosystems. If this occurs, many native insect species, especially the *Drosophila,* will be jeopardized, and the reduction in insect populations will threaten the native forest birds that feed upon them.

Hawaii's native species are not inherently fragile, but given the fact that very few of them exist anywhere else, we won't get a second chance to protect them. While it took millions of years to produce the constellation of endemic species that inhabit these island environments, their extinction could be quick work if conservation measures are not taken.

LACAWAC EXPERIENCE
August 1982

Lacawac Sanctuary is a unique wilderness within easy reach of most eastern urban centers. Its central feature, an undisturbed glacial lake, is a National Natural Landmark. The entire sanctuary, including the lodge, has been placed on the state and national Registry of Historic Places. A Conservancy model preserve, Lacawac has for years been operated as a research and learning center. Now, from Sunday, August 22 through Saturday, August 28, 1982, the quiet beauty of Lacawac is being made available to a limited number of participants—not more than 15 people. Time for relaxation and candlelight dinners will frame a delightful learning experience. Sanctuary staff and guest specialists will be available to help unlock the wonders of the natural world. This 7 day, 6 night opportunity is available for $750 per couple, of which $300 is a tax-deductible contribution. (Based on double occupancy).

For details and reservations, contact: Lacawac Sanctuary, R.D. 1, Lake Ariel, PA 18436; or call (717) 689-9494.

CONSERVATIONISTS HONORED

At a reception in Washington, D.C., on May 20, three Nature Conservancy staff members were honored with 1982 Gulf Oil Conservation Awards. The national awards are presented yearly to 10 professional and 10 citizen winners for dedicated service in the field of conservation. The Conservancy's award recipients are Ray M. Culter, Geoffrey S. Barnard, and Henry P. Little.

Now director of the Conservancy's trade lands program, Mr. Culter spent almost a decade organizing and building a preserve stewardship program and creating an effective group of staff and volunteers to manage more than 700 Conservancy preserves across the country. As western regional director, Henry Little led successful efforts to protect areas like California's Santa Cruz Island and the McCloud River, as well as Silver Creek in Idaho. Mr. Little is currently working to safeguard habitat for the endangered native forest birds of Hawaii. Geoffrey Barnard is director of the Minnesota Field Office and advisor to the National Park Foundation of Costa Rica for the Conservancy's International Program. He is responsible for having secured approximately 30,000 acres of native grasslands in five midwestern states.

This year's Gulf Oil Conservation Award winners in the "citizen category" include four people who have assisted the Conservancy as dedicated and generous volunteers. Kenneth and Helen Morrison were instrumental in helping the Conservancy secure 3,000 acres of Florida's wild and pristine Tiger Creek; R. Philip Hanes, Jr., of Winston-Salem, North Carolina, provided leadership for the Conservancy's drive to save the Outer Banks; and Arthur (Skipper) Tonsmeire assisted the Conservancy in implementing its Rivers of the Deep South Program and creating Alabama's Bon Secour Wildlife Refuge. Two other award recipients are also Conservancy members: Milton W. Weller of St. Paul, Minnesota, and Eva Patten of Tempe, Arizona.

Each award winner received a bronze plaque, a citation, and a $500 honorarium. Gulf Oil assumed sponsorship of the awards program last fall from American Motors, which instituted the program in 1953.

NEW PROJECTS

ALABAMA

Dennis Cove (Mobile County). Here along the West Fowl River, part of the lower estuary that flows into Mississippi Sound, a 158-acre gift of land from Charles L. Rutherford, J. Schley Rutherford, and John F. Van Hoof embraces Gulf Shore salt marsh backed by pines. The Mobile Bay area, of which Mississippi Sound is a component, has been targeted for protection under the Conservancy's Rivers of the Deep South Program. Dennis Cove is currently managed by the Conservancy's Southeastern Regional Office.

CONNECTICUT

Hoadley Creek (Town of Guilford). A 100-acre stretch of freshwater swamp and hilly upland riddled with granite outcrops is a new Guilford Land Trust preserve. The Conservancy assisted the local land conservation group in acquiring the natural area, a recreational retreat skirting Hoadley Creek in suburban Connecticut—just two-and-a-half hours from Manhattan .

ILLINOIS

Mettler Woods (DeWitt County). Islanded among plowed fields, this 80-acre dry-mesic woodland is the only undisturbed plant community of its kind in the county—and one of only eight in the state's Grand Prairie Division. Once common here, white oak forests have been cut back owing to the agricultural suitability of the region's organically rich young soils. The property, which will be managed by a local land steward under the supervision of the Illinois Field Office, is charted for dedication as a state nature preserve.

MAINE

Coggins Head (Washington County). At high tide Coggins Head, an 80-acre peninsula near the Canadian border, juts out into the swift currents of Cobscook Bay; but when the waters recede by some 25 feet to their lowest ebb, this wooded headland presides over mud flats and puddles. These dramatic fluctuations offer up an abundance of marine-life prey, making the area prime habitat for raptors such as osprey and bald eagles. Situated smack in the center of Maine's raptor-nesting country, Coggins Head has been judged the state's top protection priority by the University of Maine at Orono's Bald Eagle Project. It will be managed by the Maine Chapter.

MINNESOTA

Blue Gentian Prairie (Jackson County). Crowning a small hill, this showy prairie remnant overlooks cornfields as far as you can see. Strewn among its dominant little bluestem and Indian grasses are purple coneflowers, lead plants, blazing stars, blue (or downy) gentians . . . making for an opulent display when the plants are in blossom. Upland plovers, classified as rare in the state, nest on the six-acre property—one of the last dry-mesic prairie communities left in southern Minnesota. A conservation priority of the state natural heritage program, Blue Gentian Prairie is managed by the Minnesota Chapter, which is working to raise $20,000 by December to cover project costs.

MONTANA

Blackfoot River—Addition—(Powell County). In Big Sky country northwest of Helena, the Blackfoot River cuts a corridor through foothills and lowland forests—habitat for black bears, mountain lions, wolverines, coyotes, Canada lynxes, elk, beavers, white-tailed deer, great blue herons, myriad ducks, and a key winter migration route for bald and golden eagles. Marguerite T. Heller has donated a conservation easement on an undisturbed 400 acres at the northern end of the Conservancy's project assemblage, which now spans 4,751 acres. As the river loops and swerves across the property, it forms numerous oxbows and three oxbow lakes: abandoned river channels lush with willows and dogwoods. More than half of the addition is floodplain forested with cottonwoods and aspen; the rest is upland fir forests and fescue-bunchgrass prairie. The Big Sky (Montana/Wyoming) Field Office will monitor the easement.

NORTH CAROLINA

Nags Head Woods—Addition—(Dare County). With the acquisition of a 50-acre tract on the forest's southern edge, the Conservancy has brought a total of 585 acres under protection here on Roanoke Sound. A national natural landmark lodged among the back barrier dunes of North Carolina's Outer Banks, this maritime forest ecosystem—where northern and southern plant species *coexist,*

Loess Hills

Deep, windblown silt (or "loess," from the German for "loose") and subsequent erosion have corrugated this landscape for hundreds of square miles. Geologists compare it to the loess hills of China's Kansu Province—and to no place else on earth.

The look of Loess Hills, Iowa, an 800-acre expanse of narrow parallel ridges siding steep ravines, is immediately impressive for its topographical oddity and grand scale. But the new Conservancy preserve just north of Sioux City holds many subtler attractions: native midgrass and tallgrass prairies capping the fertile ridges in fingerlike extensions; bur oak ranging down the shaded slopes to stream bottoms; and a zone of rough-leaved dogwood and smooth sumac between the two.

One of the Conservancy's "national critical areas," land judged to represent the nation's most jeopardized habitats and ecosystems, the Loess Hills region boasts the highest concentration of endangered species in Iowa. Two state-endangered animals, the prairie rattlesnake and the grasshopper mouse, prosper here, as do rare Plains pocket mice and southern bog lemmings. The buffalo berry shrub, also listed as rare in the state, grows on the ridge-tops; and more than a dozen other plants (including a yucca) find their easternmost range limit on the area's well-drained slopes, where soil conditions mimic Great Plains environments.

Acquisition and stewardship costs will be met with Goodhill Foundation challenge grant funds (under the Conservancy's National Critical Areas Program), payment from Plymouth County (to which the Conservancy will eventually convey the land for management as a state nature preserve), and contributions to the Iowa Field Office's Loess Hills campaign. Because there is a great deal left to discover in this hilly range, the newly established Iowa Natural Areas Inventory is scheduling field research for the summer months; and the State Preserves Advisory Board, which has already completed studies on the area's mammals and mosses, will investigate its plant communities, birds, snails, amphibians, and reptiles in the coming year. The data gathered will be of great use to the Conservancy as it begins work with the county's conservation board on a preserve master plan.

many at their geographic limits—was fostered by the convergence of warm Gulf Stream waters and cold currents from Labrador. Its spectrum of wetland communities (freshwater ponds, swamp thickets, subterranean reservoirs, brackish marsh) and its oak-hickory forest harbor a number of state-endangered birds and plants. The "national critical area" is managed by two professional Conservancy preserve stewards.

OHIO

T[redacted] Wilderness—Addition—(Adams County). Set in rough hill country on the edge of the Appalachian highland, this national natural landmark is a mosaic of mixed mesophytic forest, remnant prairies, and cedar glades. A recent 143-acre acquisition here extends Conservancy-protected habitat for two state-endangered plants, Canby's mountain lover (which is also a candidate for federal listing) and crested coral root. The Wilderness, now 535 acres all told, lies at the northern end of the Edge of Appalachia Preserve System, which covers more than four square miles in southern Ohio. The Conservancy's Ohio Chapter has devoted acquisition efforts to this assemblage, owned and managed by the Cincinnati Museum of Natural History, for two decades. (See box below on the *Ohio Lands Forever Drive.*)

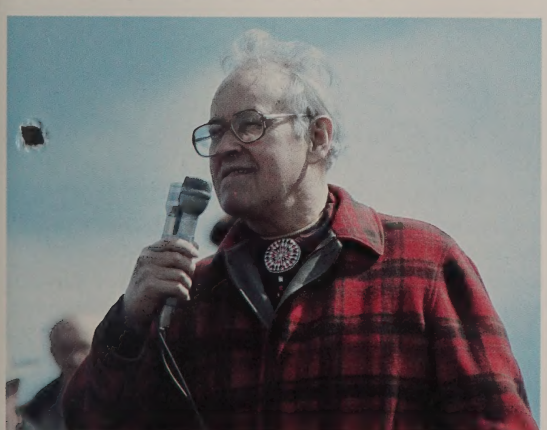
WISCONSIN

Brule River—Addition—(Douglas County). The gift of a conservation easement on 36 acres with river frontage, pines, and northern hardwoods brings Conservancy protection along this northern Wisconsin river to 4,849 acres. The upper watershed of the Brule boasts nine major biotic communities, including virgin pine forests, cedar swamps, alder thickets, lowland hardwoods, oak and pine barrens, aspen woods. . . . The Wisconsin Chapter has gained conservation easements on 96 percent of the private lands in its 9-mile long project area: the wildest, most ecological diverse stretch in the river's run north to Lake Superior.

Oregon Preserve Dedicated to Former-Governor Tom McCall

The Conservancy has dedicated its outstanding preserve on the Rowena Dell Plateau to Tom McCall, governor of Oregon from 1967 to 1975. As governor, he established a statewide land-use planning agency (the Oregon Department of Land Conservation and Development) unexampled elsewhere in the nation. His countless services to the cause of conservation include two terms on the Conservancy's Board of Governors.

The Oregon Chapter is currently working to raise $20,000 for the Governor Tom McCall Preserve at Rowena. Donations honoring McCall should be forwarded to the Rowena Fund—at either the Oregon Field Office in Portland or the Conservancy's national headquarters.



Tom McCall (photo by Geoff Pampush)

Ohio Lands Forever—Now!

Ohio's early settlers wrote of forests so deep they were void of daylight.

And eight-foot-high prairie grasses.

And lush Appalachian hills.

And wetlands alive with birds and fish.

Ninety-nine percent of Ohio's natural landscape has been altered. In the last two centuries, 58 animal species native to the state have been extirpated—and today, two-thirds of the remaining 81 inhabit *unprotected* lands.

The Conservancy's Ohio Chapter has set its protection sights on eleven critical natural areas, all of which provide habitat for highly jeopardized plants, animals, or communities.

The Ohio Lands Forever Drive has a $1.4-million campaign goal, $450,000 of which remains to be raised. Funds will go to safeguard and care for Ohio's most ecologically significant prairies, forests, caves, and wetlands forever—now!

From time to time, The Nature Conservancy exchanges membership lists with other conservation organizations whose work might also interest you. In this way, we are able to increase the Conservancy's membership at a lower cost than would otherwise be possible. However, if you prefer *not* to receive these mailings from other organizations, please attach the mailing label from this magazine (or copy the label *exactly*) and mail it to:

Membership Secretary
The Nature Conservancy
1800 North Kent Street
Arlington, Virginia 22209

FALL TOUR OFFERED:

ADIRONDACK MOUNTAINS

Containing 9,000 square miles in northern New York, the Adirondack Park is the largest protected sanctuary in the continental U.S. Over 2½ million acres of the Park are protected as "forever wild."

The Adirondack tour offers Conservancy members and their guests the chance to visit the Park on the weekend of September 24 to 26, 1982. You will learn about the role the Adirondack Conservancy has played in preserving this vast wilderness, and stay at the famous and historic Ausable Club, which owns and protects over 7,000 acres in the heart of the high peaks region of the Adirondacks. The cost of the trip is $135.00. Don't miss this visit to "the land that nobody knows."

For details, write to Adirondack Fall Tour, c/o Travelworld, 1500 Wilson Boulevard, Arlington, Va. 22209 or call (703) 525-3605.

PHOTO CREDITS: Susan Bournique, pp. 4-5; Dave Boynton, pp. 12, 13 top; Sherwin Carlquist, pp. 7, 8 bottom, 9, 11; Mark Collins, p. 13 bottom, 14 bottom, 17; Carl Kurtz, p. 28; Tim Loomis, pp. 8 top, 19 bottom, 23 top right; Dwayne Preble, pp. 20 bottom, 21 top; Jack Selby, p. 29; Robert Shallenberger, pp. 16, 18, 20 top, 21 bottom; R. M. Towill, p. 22; Robert J. Western, pp. 14 top, 15.

Is Your Estate Up to Date?

The Economic Recovery Tax Act of 1981 necessitates a review of your assets and how you plan to distribute your hard-won possessions. As you update your will—or create one for the first time—be sure to take advantage of the Tax Act changes. And, be sure also to consider the environmental impact which a bequest to The Nature Conservancy will carry. For information, please contact: Ms. Alice Pinsley, The Nature Conservancy, 1800 North Kent Street, Arlington, VA 22209, (703) 841-5374.

VISIT A MONTANA RANCH

Join us this summer and explore the Conservancy's extraordinary Pine Butte Swamp Preserve—spectacular surroundings for riding, hiking, fishing, photography, birdwatching . . . or just relaxing.

Al and Sally Haas invite you to stay at a unique dude ranch in the heart of Montana's Rocky Mountain Front. For more information, contact the Circle 8 Ranch, P.O. Box 457, Choteau, Montana 59422/(406) 466-5564.

NEXT IN THE NEWS:
BEYOND OUR BORDERS

The July/August issue brings you an overview of the Conservancy's International Program—taking you to Costa Rica, Colombia, Chile. Read about North American birds that winter in the tropics; read about conservation beyond our borders—next in the *News*.

VISIT DOG ISLAND

It's a pristine barrier island 20 miles off Florida's Gulf Coast—and you're invited! The Conservancy owns 75 percent of 1,800-acre Dog Island at the eastern end of Apalachicola Bay. Its beaches offer the finest shelling in the state, and there are countless other recreational opportunities. Eight modern apartment units are available for rental. For more information write to Mr. Dan Tonsmeire, c/o The Pelican Club, P.O. Box 301, Carrabelle, Florida 32322, or call (904) 697-2839. Conservancy members will receive special consideration.

NEW LIFE MEMBERS

An individual becomes a Life Member of The Nature Conservancy upon contribution of $1,000 for membership dues or for the Land Preservation Fund, Guarantee & Income Fund, or a State Land Preservation Fund.

We regret that space precludes listing all of those who have become Life Members since the last issue. We'll publish additional names in the next *News*. Please accept our apologies for the delay.

Mr. Joseph Allworthy
Illinois
Dr. Rainer G. Arnhold
California
Miss Alexandra Blair
Illinois
Frank and Ann Boren
California
Ms. Ruth A. Bradley
California
Ms. Katherine F. Caldwell
California
Dr. & Mrs. Hubert I. Caplan
Maine
Mr. William M. Constable
Massachusetts
Ms. Leone M. Dauvergne
New York
Mr. Edward N. Dayton
Minnesota
Mr. & Mrs. Thomas Dolan IV
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Mrs. Truman B. Douglass
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Mr. William H. Evans
Idaho
Mrs. Gertrude H. Fay
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Mrs. Florence Fischgrund
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Connecticut
Mrs. Austin Gresham
Kentucky
Miss Kathlene M. Holser
California
Mrs. Gail C. Karges
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Colorado
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Ms. Blanche Vranna
California
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Pennsylvania
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Tennessee
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Florida
Mr. & Mrs. Donald M. Wiley
Arizona
Mr. William T. Wise
Minnesota
Mr. Harold M. Wit
New York

NEW HONORARY MEMBERS FOR LIFE

Donors of natural land, conservation easements, perpetual interests in natural areas, or irrevocable deferred gifts are recognized as Honorary Members for Life.

Mr. B. A. Brady
Mississippi
Alexander & Bette Castle
Minnesota
Mr. Mandell Cypress
Tennessee
Mary Banning & Gardner Friedlander
Wisconsin
Mr. Jerome Guttman
Tennessee
Bruce & Marion Miller
Illinois
Mrs. Olive Nelson
Minnesota
Richard & Inez Nelson
Pennsylvania
Mrs. Katherine M. Osborn
Wisconsin
Mr. Jack Parker
Tennessee
Carl & Sonja Pearson
Florida
Michael & Jeanne Roll
Oregon
Donald & Beryl Simonds
Wisconsin
Ms. Mary C. Van Evera
Minnesota
Mrs. Sarah R. Werner
Colorado

NEW CORPORATE ASSOCIATES

A corporation becomes a Corporate Associate of The Nature Conservancy upon contributing between $1,000 and $10,000 annually to the operations of the organization.

American Maize-Products Company
Connecticut
Anaconda Aluminum Company
Kentucky
Arizona Public Service Company
Arizona
Brenton Banks, Inc.
Iowa
Burlington Northern Foundation
Washington
City National Bank
North Carolina
David Muench Photography, Inc.
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Detroit Edison
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Johnson Controls Foundation
Wisconsin
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Wisconsin
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